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Contract Report for 8/2019

1. Project Title: Artificial Intelligence for Tactical Logistics

2. Performer: Penn State University-Applied Research Lab

3. Contract or Grant (if applicable): N00014-19-PR-00047

4. Principal Investigator Name: Robert Walter, rlw9@arl.psu.edu, o 814-571-2488, (b)(6) [redacted]

5. Future Major Project Milestones: (Deliverables, Tests, Experiments, etc.)

Milestone Title	Description / Impact	Date
Task 1 - Add Log to BKA	• Semantically enrich the logistics messages passed on the TSOA by annotating the schemas with ontological representations. • Create logistics models in the BKA that will be reported in each of the tactical logistics reports and mapped back into the event timeline. (b)(4) [redacted] risks and leverage operational opportunities. • Extend user interfaces to include logistics information. • Provide demonstrations to and exercises with the MCSC and MCWL. (b)(4) [redacted]	12/31/2019
Task 2 – Analyze Tactical Logistics Planning Needs	• Analyze the tactical logistics planning requirements for supporting the Autonomous Aerial Resupply (AAR) initiative. • Identify requirements which could feasibly be met by AI techniques and identify preliminary techniques. • Identify data elements required to support AI algorithm development and operational use. • Assess feasibility and expected impacts and select best candidates for prototype development in Task 3.	3/31/2020
Task 3 – Develop Logistics Planning Services	• Define and develop planning services to understand tactical logistics demands, where supplies and delivery capabilities are located, and how to effectively deliver and match capabilities to prioritized tactical needs. • Apply AI techniques identified in Task 2 to develop AI models which meet the identified planning	12/31/2021

	requirements using data provided by the BKA and implement within planning services. • Develop optimization models to execute operational, dynamic supply and demand matching and asset tasking. • Develop an operational simulation that generates and publishes logistics status messages to the TSOA used to evaluate the operational effectiveness of dynamic logistics planning. • Develop a user interface to integrate capabilities.	
Task 4 – Develop Logistics Planning and Analytical Interface	• Define and develop a logistics planning and analytical interface between the TSOA and Agile Cloud Services (ACS) or Tactical Cloud Reference Implementation (TCRI) afloat in order to leverage a distributed planning and analytic capability.	3/31/2021
Task 5 – Assess Distributed Logistics Ledger and Distributed Applications	• Assess use cases for applying distributed logistics ledger and distributed applications (Dapps) using blockchain smart contracts that operate in a disconnected, intermittent and low bandwidth (DIL) environment and operate when disconnected from enterprise resource planning (ERP) systems. Use red-cell techniques to assess cybersecurity strengths and weaknesses.	3/31/2020

6. Reporting Period Narrative: (Description of research performed focusing on the technology or new discovery; make particular mention to the research challenges/issues; publications/theses, etc.)

Task 1 – Started designing logistics models for the BKA and mapping information ingested through LOGSTAT reports into ontological structures.

Task 2 – Refined the EAB scenarios based on feedback from HQMC I&L NexLog. Continued research into the taxonomy of AI and frameworks suitable for the expeditionary logistics domain. Investigated simulation tools needed to generate the data needed to train AI. Also considering how to integrate logistics simulations with C2 simulations. Evaluating GOTS (Joint Deployment Logistics Model), COTS LlamaSoft) and custom simulation options.

Task 3 – None.

Task 4 – None.

Task 5 – Relay application consumes Hyperledger Fabric blocks and emits them to ActiveMQ for consumption by validator. Validator consumes relay blocks and creates an internal data structure to represent the published information. Validator now consumes Permission Request file and checks that the Permission Request is composed of valid certificates, that the certificates have been published, and that the attribute required for giving permission has been satisfied by the certificates in the Permission Request file.

Added functions to

7. Risk: (All projects have risks associated with cost (potential for overruns), schedule (slippage), and technical performance)

No.	Explain Risk & Impact if Realized	Mitigation Strategy	Change from Previous (New, Increasing, Decreasing, Static, or Realized?)
1	Schedule: None		
2	Performance: None		
3	Technical: We are not yet certain how we will generate AI training data.	It will take about 2 months to evaluate our simulation options.	Increasing
4	Cost: None		
5	Performance: None		

8. Additional notes to program manager: (b)(4) [redacted]

9. Optional Graphics.